

What is claimed is:

1. An image forming apparatus having an LED print head where a multiplicity of LEDs capable of exposing a surface of a photoreceptor in a plurality of gradations are arranged, said image forming apparatus comprising:

setting means for calculating a highest gradation appropriate exposure amount appropriate for a highest gradation from a sensitivity characteristic of the photoreceptor and a light quantity characteristic of the LED print head, calculating a highest gradation appropriate lighting time of the LEDs that is appropriate for the highest gradation and an appropriate lighting time of the LEDs that is appropriate for each of other gradations based on the highest gradation appropriate exposure amount, and setting a lighting time of each gradation based on the highest gradation appropriate lighting time and each appropriate lighting time; and

LED driving means for lighting the LEDs for the lighting time set by the setting means in accordance with a gradation of inputted image data.

2. An image forming apparatus having an LED print head where a multiplicity of LEDs capable of exposing a surface of a photoreceptor in a plurality of gradations are arranged, said image forming apparatus comprising:

setting means for calculating a highest gradation appropriate exposure amount appropriate for a highest gradation from a sensitivity characteristic of the photoreceptor and a light quantity characteristic of the LED print head, calculating an appropriate lighting time of the LEDs that is appropriate for each gradation so that an increment of an exposure amount between the gradations including a first gradation is fixed based on the highest gradation appropriate exposure amount, and setting a lighting time of each gradation based on each appropriate lighting time; and

LED driving means for lighting the LEDs for the lighting time set by the setting means in accordance with a gradation of inputted image data.

3. An image forming apparatus having an LED print head where a multiplicity of LEDs capable of exposing a surface of a photoreceptor in a plurality of gradations are arranged, said image forming apparatus comprising:

setting means for calculating a highest gradation appropriate exposure amount appropriate for a highest gradation from a sensitivity characteristic of the photoreceptor and a light quantity characteristic of the LED print head, calculating a highest gradation appropriate lighting time of the LEDs that is appropriate for the highest gradation and an appropriate lighting time of the LEDs that is appropriate for each of other gradations based on the highest gradation appropriate exposure amount, forming a lighting clock having a gradation pulse coinciding with a multiple of a reference pulse of its own reference clock with timing substantially the same as the highest gradation appropriate lighting time and each appropriate lighting time, and setting the formed lighting clock; and

LED driving means for counting the number of gradation pulses by receiving the lighting clock set by the setting means in accordance with a gradation of inputted image data, and lighting the LEDs until each number of gradations is reached.

4. An image forming apparatus having an LED print head where a multiplicity of LEDs capable of exposing a surface of a photoreceptor in a plurality of gradations are arranged, said image forming apparatus comprising:

setting means for calculating a highest gradation appropriate exposure amount appropriate for a highest gradation from a sensitivity characteristic of the photoreceptor and a

light quantity characteristic of the LED print head, calculating an appropriate lighting time of the LEDs that is appropriate for each gradation so that an increment of an exposure amount between the gradations including a first gradation is fixed based on the highest gradation appropriate exposure amount, forming a lighting clock having a gradation pulse coinciding with a multiple of a reference pulse of its own reference clock with timing substantially the same as each appropriate lighting time, and setting the formed lighting clock; and

LED driving means for counting the number of gradation pulses by receiving the lighting clock set by the setting means in accordance with a gradation of inputted image data, and lighting the LEDs until each number of gradations is reached.

5. An image forming apparatus having an LED print head where a multiplicity of LEDs capable of exposing a surface of a photoreceptor in a plurality of gradations are arranged, said image forming apparatus comprising:

setting means for calculating a highest gradation appropriate exposure amount appropriate for a highest gradation from a sensitivity characteristic of the photoreceptor and a light quantity characteristic of the LED print head, calculating a highest gradation appropriate lighting time of the LEDs that is appropriate for a highest gradation and to which a loss time at the time of start of lighting is added and an appropriate lighting time of the LEDs that is appropriate for each of other gradations and to which the loss time is added based on the highest gradation appropriate exposure amount, and setting a lighting time of each gradation based on the highest gradation appropriate lighting time and each appropriate lighting time; and

LED driving means for lighting the LEDs for the lighting time set by the setting means in accordance with a gradation of inputted image data.

6. An image forming apparatus having an LED print head where a multiplicity of LEDs capable of exposing a surface of a photoreceptor in a plurality of gradations are arranged, said image forming apparatus comprising:

setting means for calculating a highest gradation appropriate exposure amount appropriate for a highest gradation from a sensitivity characteristic of the photoreceptor and a light quantity characteristic of the LED print head, calculating an appropriate lighting time of the LEDs that is appropriate for each gradation and to which a loss time at the time of start of lighting is added so that an increment of an exposure amount between the gradations including a first gradation is fixed based on the highest gradation appropriate exposure amount, forming a lighting clock having a gradation pulse coinciding with a multiple of a reference pulse of its own reference clock with timing substantially the same as each appropriate lighting time, and setting the formed lighting clock; and

LED driving means for counting the number of gradation pulses by receiving the lighting clock set by the setting means in accordance with a gradation of inputted image data, and lighting the LEDs until each number of gradations is reached.

7. An image forming apparatus according to claim 1, wherein said highest gradation appropriate lighting time fulfills the following expression:

$$T = (E \cdot 2.54^2 \cdot 10^6) / (P \cdot M \cdot N) + \Delta T$$

where $E = a \cdot E_{1/2} = a \cdot E' \cdot (V_0 - V_{1/2}) / (V_0 - V)$, T is the highest gradation appropriate lighting time, ΔT is the loss time at the time of start of lighting, P is an average light quantity per LED, M is a main scanning resolution, N is a sub scanning resolution, E is the highest gradation appropriate exposure amount, a is a fixed coefficient, $E_{1/2}$ is a half decay

exposure amount, E' is an exposure amount of the photoreceptor when sensitivity is measured, V_0 is a dark potential of the photoreceptor, $V_{1/2}$ is a light potential at the time of half decay exposure, and V is a light potential of the photoreceptor when sensitivity is measured.

8. An image forming apparatus according to claim 2, wherein said appropriate lighting time fulfills the following expression:

$$T_{n/m} = \{n/(m-1)\} \cdot (E \cdot 2.54^2 \cdot 10^6)/(P \cdot M \cdot N) + \Delta T$$

where $E = a \cdot E_{1/2} = a \cdot E' \cdot (V_0 - V_{1/2})/(V_0 - V)$, $T_{n/m}$ is the appropriate lighting time of an n -th gradation, ΔT is a loss time at the time of start of lighting, m is a number of gradations, n is an ordinal number for the gradations ($=0, 1, \dots, m-1$), P is an average light quantity per LED, M is a main scanning resolution, N is a sub scanning resolution, E is the highest gradation appropriate exposure amount, a is a fixed coefficient, $E_{1/2}$ is a half decay exposure amount, E' is an exposure amount of the photoreceptor when sensitivity is measured, V_0 is a dark potential of the photoreceptor, $V_{1/2}$ is a light potential at the time of half decay exposure, and V is a light potential of the photoreceptor when sensitivity is measured.

9. An image forming apparatus according to claim 2, wherein said appropriate lighting time fulfills the following expression:

$$T_{n/m} = \{n/(m-1)\} \cdot (E \cdot 2.54^2 \cdot 10^6)/(P \cdot M \cdot N) \cdot (1 + 0.01 \cdot \beta_1) / \{1 + 0.01 \cdot \alpha_1 \cdot (K' - K)\} + \Delta T \cdot (1 + 0.01 \cdot \beta_2) / \{1 + 0.01 \cdot \alpha_2 \cdot (K' - K)\}$$

where $E = a \cdot E_{1/2} = a \cdot E' \cdot (V_0 - V_{1/2})/(V_0 - V)$, $T_{n/m}$ is the appropriate lighting time of an n -th gradation, ΔT is a loss time at the time of start of lighting, m is a number of gradations, n is an ordinal number for the gradations ($=0, 1, \dots, m-1$), K is a temperature

detected by a temperature sensor, K' is a basic set temperature, α_1 is a temperature correction coefficient in an effective lighting time, α_2 is a temperature correction coefficient in the loss time at the time of start of lighting, β_1 is an image density correction coefficient in the effective lighting time, β_2 is an image density correction coefficient in the loss time at the time of start of lighting, P is an average light quantity per LED, M is a main scanning resolution, N is a sub scanning resolution, E is the highest gradation appropriate exposure amount, a is a fixed coefficient, $E_{1/2}$ is a half decay exposure amount, E' is an exposure amount of the photoreceptor when sensitivity is measured, V_0 is a dark potential of the photoreceptor, $V_{1/2}$ is a light potential at the time of half decay exposure, and V is a light potential of the photoreceptor when sensitivity is measured.

10. An image forming apparatus according to claim 7, wherein said a is 2 to 3.5.

11. An image forming apparatus according to claim 1, wherein said sensitivity characteristic of the photoreceptor is a light potential when sensitivity is measured, and said light quantity characteristic of the LED print head is an average light quantity per LED.

12. An image forming apparatus according to claim 1, wherein a surface of said photoreceptor is amorphous silicon.

13. An image forming apparatus according to claim 1, wherein a plurality of image forming units each comprising said photoreceptor, said LED print head, said setting means and said LED driving means are provided.

14. An image forming apparatus according to claim 4, wherein said increment between the gradation pulses of the lighting clock is fixed.

15. An image forming apparatus according to claim 4, wherein said increment between the gradation pulses of the lighting clock is substantially fixed.